CLAIMS

1. A diagnostic method comprising the steps of:

(a) examining an *in-vivo* tissue sample using an optical signal detection system adapted to automatically assign a classification to each of a plurality of regions of the tissue sample;

(b) creating an overlay map visually indicating the classifications assigned to the regions of the tissue sample; and

(c) displaying the overlay map to facilitate identification of suspect portions of the tissue sample.

2. The method of claim 1, wherein step (c) comprises superimposing the overlay map onto an image of the tissue sample.

3. The method of claim 2, wherein the image of the tissue sample is a reference image.

4. The method of claim 3, wherein the tissue sample comprises cervical tissue and the reference image is a colposcopic image.

5. The method of claim 2, wherein step (c) comprises displaying the overlay map superimposed onto a real-time colposcopic image of the tissue sample.

6. The method of claim 1, wherein step (c) comprises projecting the overlay map onto the tissue sample.

7. The method of claim 1, wherein steps (a) through (c) are performed during the course of a single patient visit.

8. The method of claim 1, wherein the displaying step is performed substantially contemporaneously with the examining step.

9. The method of claim 1, wherein the classification in step (a) comprises a tissue-class probability.

10. The method of claim 1, wherein the classifications assigned to the regions of the tissue sample comprise at least one of the categories selected from the group consisting of necrotic, CIN 2/3, NED, and indeterminate.

11. The method of claim 1, further comprising the steps of:

(d) identifying at least one suspect portion of the tissue sample; and

(e) marking the at least one suspect portion.

12. The method of claim 11, wherein step (e) comprises marking the at least one suspect portion using at least one of an endogenous agent and an exogenous agent.

13. The method of claim 11, wherein step (e) comprises marking at least one suspect portion using at least one of a photobleaching technique and a photoactivation technique.

14. The method of claim 11, wherein step (e) comprises marking the at least one suspect region for follow-up examination.

15. The method of claim 11, wherein step (e) comprises marking the at least one suspect region for treatment.

16. The method of claim 11, wherein steps (a) through (e) are performed during a single patient visit.

17. The method of claim 1, further comprising the steps of:

(d) identifying at least one suspect portion of the tissue sample; and

(e) excising tissue from the at least one suspect portion for biopsy.

18. The method of claim 1, further comprising the steps of:

(d) identifying at least one suspect portion of the tissue sample; and

(e) treating the at least one suspect portion.

19. The method of claim 18, wherein step (e) comprises performing at least one of: photodynamic therapy, cryotherapy, and direct chemical treatment.

20. The method of claim 18, wherein step (e) comprises performing photodynamic therapy using at least one photosensitive agent.

21. The method of claim 20, wherein the at least one photosensitive agent comprises at least one of an exogenous agent and an endogenous agent.

22. The method of claim 20, wherein the at least one photosensitive agent comprises at least one of a hematoporphyrin, a phthalocyanine, and a chlorin.

23. The method of claim 20, wherein the at least one photosensitive agent comprises at least one of dihematoporphyrin, 5-aminolevulinic acid, protoporphyrin IX, temoporfin, and meso-tetrahydroxyphenylchlorin.

24. The method of claim 18, wherein step (e) comprises removing tissue from the at least one suspect portion using laser ablation.

25. The method of claim 18, wherein steps (a) through (e) are performed during a single patient visit.

26. A system for detection of suspect portions of a tissue sample, the system comprising:

(a) an optical signal detection apparatus adapted to obtain at least one optical signal from each of a plurality of regions of a tissue sample;

(b) a memory that stores code defining a set of instructions;

(c) a processor that executes the instructions thereby to:

(i) identify a characteristic of each of the plurality of regions based at least in part on the at least one optical signal; and

(ii) define an overlay map for visually indicating the characteristics identified in step (i); and

(d) a display for facilitating identification of suspect portions of the tissue sample according to the overlay map.

27. The system of claim 26, wherein the optical signal detection apparatus comprises illuminating optics for illuminating each of the plurality of regions of the tissue sample and collecting optics for receiving at least one optical signal from each of the plurality of regions.

28. The system of claim 27, wherein the illuminating optics comprise a white light source and an ultraviolet light source and wherein the at least one optical signal comprises a fluorescence spectrum and at least one reflectance spectrum.

29. The system of claim 28, wherein the at least one optical signal comprises a fluorescence spectrum and two reflectance spectra.

30. The system of claim 27, wherein the optical signal detection apparatus comprises optics for obtaining a sequence of images of the tissue sample useful for motion compensation.

31. The system of claim 27, wherein each of the plurality of regions has a dimension of about a millimeter.

32. The system of claim 31, wherein each of the plurality of regions has a diameter of about 0.7 mm.

33. The system of claim 27, wherein the optical signal detection apparatus is adapted to complete a cervical scan in less than about 30 seconds.

34. The system of claim 33, wherein the optical signal detection apparatus is adapted to complete a cervical scan in less than about 15 seconds.

35. The system of claim 26, wherein the display shows the overlay map superimposed onto an image of the tissue sample.

36. The system of claim 35, wherein the image of the tissue sample is a reference image.

37. The system of claim 35, wherein the tissue sample comprises cervical tissue and the reference image is a colposcopic image.

38. The system of claim 35, wherein the display shows the overlay map superimposed onto a real-time colposcopic image of the tissue sample.

39. The system of claim 35, wherein the display can be viewed through a viewfinder.

40. The system of claim 35, wherein the display is a surface upon which the overlay map can be projected.

41. The system of claim 26, wherein the display is a projection of the overlay map onto the tissue sample.

42. The system of claim 26, further comprising a tool for marking a suspect region of the tissue sample.

43. The system of claim 26, further comprising an instrument for excising tissue from a suspect portion of the tissue sample for biopsy.

44. The system of claim 26, further comprising an instrument for treating tissue from a suspect portion of the tissue sample.

45. The system of claim 26, further comprising a laser for ablating tissue within a suspect portion of the tissue sample.

46. The system of claim 26, further comprising a light source for performing photodynamic therapy to treat the suspect portions of the tissue sample.

47. An optical signal detection apparatus for performing a cervical scan, the apparatus comprising:

(a) illuminating optics for sequentially illuminating each of a plurality of regions of a tissue sample, wherein the illuminating optics comprise a white light source and an ultraviolet light source; and

(b) collecting optics for receiving at least one optical signal from each of the plurality of regions, wherein the at least one optical signal comprises a fluorescence spectrum and at least one reflectance spectrum, wherein each of the plurality of regions has a dimension of about a millimeter, and wherein the optical signal detection apparatus is adapted to complete a cervical scan in less than about 30 seconds.

48. The apparatus of claim 47, wherein the optical signal detection apparatus is adapted to complete a cervical scan in less than about 15 seconds.

49. The apparatus of claim 47, wherein the plurality of regions of the tissue sample comprises from about 100 to about 1000 regions of the tissue sample.

50. The apparatus of claim 49, wherein the plurality of regions of the tissue sample comprises about 500 regions.

51. The apparatus of claim 47, comprising a light source for performing photodynamic therapy.

52. A method for identifying a characteristic of each of a plurality of regions of a tissue sample, the method comprising the steps of:

(a) obtaining at least one optical signal from each of a plurality of regions of a tissue sample following application of a contrast agent and at least one of an optical probe and a biological-responsive probe to the tissue sample; and

(b) automatically identifying a characteristic of each of the plurality of regions based at least in part on the at least one optical signal.

53. The method of claim 52, wherein the optical probe comprises a spectroscopic enhancer.

54. The method of claim 52, wherein the biological-responsive probe comprises telomerase.

55. The method of claim 52, wherein step (b) comprises applying at least one of an optical probe and a biological-responsive probe to the tissue sample in order to detect at least one member selected from the group consisting of collagen, porphyrin, FAD, and NADH.

56. The method of claim 52, further comprising the steps of:

(e) creating an overlay map visually indicating the characteristics identified in step (d); and

(f) displaying the overlay map to facilitate identification of suspect portions of the tissue sample.

57. The method of claim 52, wherein the at least one optical signal comprises a fluorescence spectrum and at least one reflectance spectrum, and wherein step (b) comprises identifying a characteristic of a subset of the plurality of regions based at least in part on a fluorescent biomarker signal.